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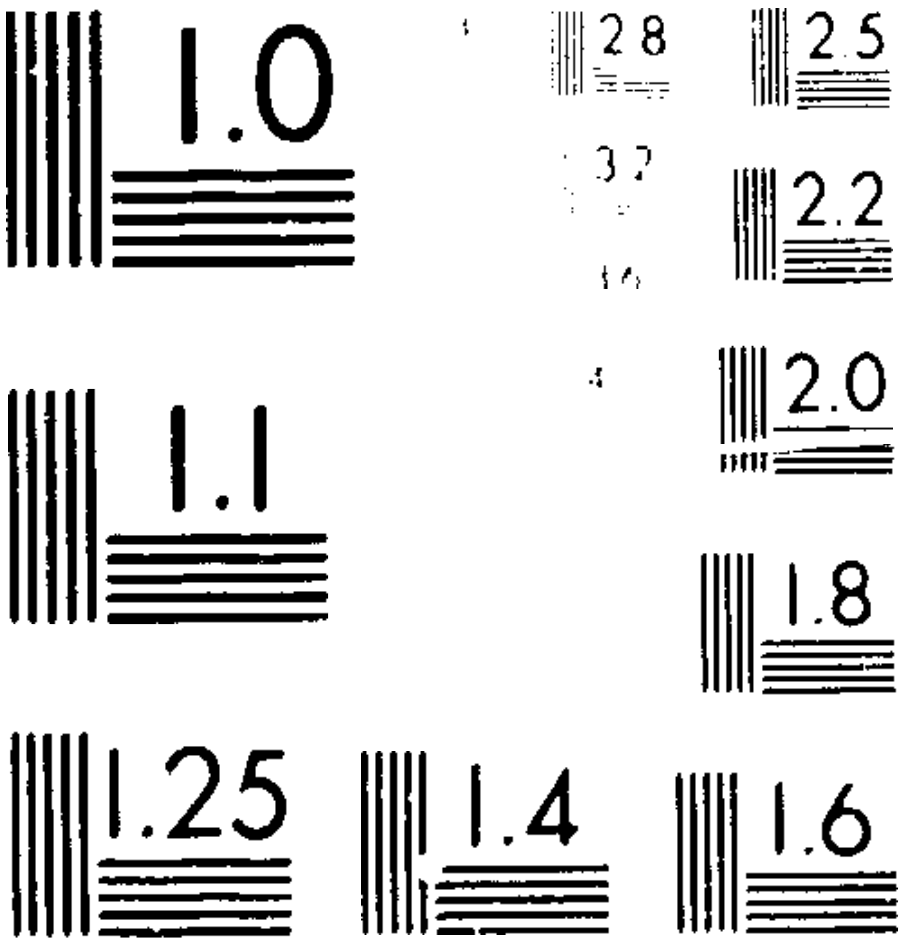
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MINI-HYDRO IN MALAYSIA*

by

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Present Status

Of the 22 projects that have been planned to be carried out by the National Electricity Board of Malaysia in 1980/81, 3 sites are in the process of construction and the further 6 are in the tender preparation stages. Work on the additional 13 sites are expected to start in early 1981. The construction of these civil works will be given to local contractors with ability to carry out the required work within standards stipulated by the Board. It is also envisaged that 82 sites in Peninsular Malaysia (which has to be implemented by the National Electricity Board with consultants selected by the Government) will be tendered out for the 5 years of the 4th Malaysian Plan.

With the in-coming of mini-hydro development it is expected that the rural industrialization will take place thus augmenting cottage industries and those industries of agrigultural nature. It is seen that certain rural development bodies in the country have planned their strategies for rural industries and small town centres to be located in the range of mini hydro stations, in contrast to the present concept where these towns or villages are being supplied by diesel generating sets.

The potential of mini hydro in Peninsular Malaysia is large and if harnessed properly can contribute a considerable amount of energy to the country's rural development needs.

Organization

The implementation of the mini hydro programme is the responsibility of the National Electricity Board and a unit has been formed in August 1979 under the Research and Development Department designated the Mini Hydro Team. This team consists of 12 engineers controlling a staff both technical and clerical totaling 64 people. The team is headed by the Project Manager and assisted by the Project Engineer under whom there are 3 sections with the following headings.

1. Feasibility study and survey section,
2. Design and construction section,
3. Electro mechanical sections.

Each of these sections has an engineer in charge with their respective assisting engineers and technical staff. To further elaborate the activities undertaken by the team, the following can be said of the sections.

1. Feasibility studies and survey section - this section deals with the potential of mini hydro, the social economic aspects, feasibility study and survey of the areas where the mini hydro stations are to be sited. Data collected by this section would be processed and thereby form the basis for the conceptual design of the power plant, route of transmission lines etc. Computer analysis of data will determine the economic viability of the project, and also establish design specification criteria for the penstock and the mini-hydro power plant.

2. Design and Construction section - this unit, after receiving necessary data from both the Feasibility study and survey section and the Electro Mechanical section start the design work. Design involves hydraulic analysis taking into consideration water required for domestic supply, irrigation and for power generation, bearing in mind the concept of integrated planning. Complete design includes those of the wier or dam (if necessary), settling basin, head race, forebay, penstock and power station building. After tendering, the section sends a site supervisor to work with the Contractors from site resurvey till the completion of the Civil Structures. This checks the quality of Civil Works and records progress of Civil Works and data in fed back to the design team for alteration if necessary.

3. Electro Mechanical Section - on receiving data from the Feasibility study and survey section, this unit draws up the specification for the Electro Mechanical plants required for the appropriate sites. The section tenders out for these plants and carries out plant selection, assessment and negotiation and award. Inspection, installation and commissioning and one year monitoring is also carried out by this unit. The monitoring forms the basis of future selection.

Management and Operation

The Management and Operation of the mini hydro station is being taken care of by the Generation and Distribution departments of the National Electricity Board. Maintenance is carried out under the Diesel section of the generation department and the maintenance group consists of several teams spread all over the country. Operation of the mini-hydro station is under the Wing of the Distribution Department at the district level. The operating hand runs the station, reports on breakdown and faults, clearing of debris, oiling the bearing etc.

Techno - Economic and Engineering Data

3 sites are now in the process of construction with a further six coming in line in 1981 see table 1. These are owned by the National Electricity Board and managed by the Board. Finance is wholly by the Malaysian Government under its Rural Electrification Programme.

Salient Techno Economic Features

Mini Hydro Electric Generation is not new to Malaysia but the recent interest in mini hydro has been due to the extensive rural electrification programme as well as the rising cost in diesel fuel. As a result the comparative evaluation of mini hydro plants and diesel stations up to 500 KW were made and these were found to favour mini hydro development. In several instances the pay back periods for these systems were very encouraging. Furthermore, the abundant small rivers and streams in the country makes it very possible the formation of mini grids close to habited areas. The logging tracks and the good road system in the country put many potential mini hydro sites in a good approachable position both technically and economically.

Capacities and Capability for local manufacturing

Many small foundries throughout Peninsular Malaysia have had vast experience in the fabrication and casting of water pumps of types mainly concerning the tin mining industry. As such, turbine runners and casing have been made for replacement purposes as far back as around 1900 and these turbines were copies of European design. The local manufacturers are capable to a large extent in fabrication and working on various metals. Where sophisticated turbine governors come into play it is obviously cheaper to import standard governors and perhaps modified diesel governors for the use of mini hydro plants.

Existing Programme for Development and Training

Foreign consultants have been appointed by the Government of Malaysia to carry out up to the pre-tender specifications for 102 sites in the whole of Malaysia, 82 of which will be in the Peninsular Malaysia. The terms of reference of these consultants include transfer of technology and training for local consultants in partnership with them as well as training for engineers and the staff of the National Electricity Board. Apart from

that the National Electricity Board will carry out the training of the mini hydro teams with or without the help of seconded engineers from overseas. The training programme is intended to prepare the mini hydro team to carry out 20 projects a year for the 4th Malaysia programme.

Other Matters in Mini Hydro Development

Several approaches were thought of in the mini hydro development programme and some of the following may be of interest.

1. As the mini hydro sites are mostly in the remote areas and in the tropical jungle, the use of overhead lines has been discarded. The National Electricity Board now uses overhead cables from the mini hydro sites to the main roads. This is to avoid:

(a) burying cable in rocky areas (expensive)

(b) avoid falling branches and lightning striking on bare conductors (the country's isoceraunic level is 150).

2. Water pump operating in reverse as mini hydro turbine is given due consideration and one experimental unit has been purchased. The governing is by means of thyristor load dumping devices; (electronic loading device).

3. Cross flow machines are being looked into seriously for the reasons that these are fabricated and hence easy to manufacture, or repair.

4. In the low head range of turbines the team is in the process of ordering a new turbine known as a lift translator turbine which may be used for low heads, streams and rivers. It has an advantage of being able to operate as low as half a meter head.

5. The team has developed several computer programmes on mini hydro economics water hammer problems, turbine characteristic etc.

Scheme	Gross Head (ft)	Flow 95% of Flow Time (cused)	Generator Output (KW)	Payback Period (years)	Length of Transmission Lines (Miles)	No.of Consumers (House Hold)	Connected to local grid	Length of Penstock	Approximate cost of scheme US Dollars
Sg. Ulu Dong	200	40	500	6.0	2.0	700	yes	700	1,350,000
Sg. Chepir	160	8	96	NBE	3.0	470	yes	260	577,500
Sg. Gebul	400	5	130	13.0	2.0	250	yes	780	479,500
Sg. Rek	80	50	250	7.0	1.0	620	yes	150	687,000
Sg. Pegang	180	3	51	NBE	1.0	255	yes	510	360,500
Sg. Lau	326	2	66	NBE	3.0	230	yes	730	378,500
Sg. Tebingtinggi	413	6	160	10.0	2.0	540	yes	1080	583.500
Sg. Guar	175	8	94	NBE	6.0	410	yes	340	654,000
Sg. Chempias	200	11	140	11.0	2.0	508	yes	411	589,000

NBE: No. Brbak even point due to escalating cost in replacement of runners.

* This cost includes power plant, civil works, supervision and commissioning, transmission and distribution.

Term: Transmission here means from power station to the nearest distribution substation (11 KV) distribution is from substation to consumers.